INDIAN LAKES
SOIL AND WATER INVESTIGATION

Department of the Interior
Bureau of Reclamation
Mid-Pacific Region
Sacramento, California

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INDIAN LAKES
SAMPLING AND ANALYSIS PLAN

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PROJECT/TASK ORGANIZATION

The investigation of the Indian Lakes Initial Site Assessment (IL) will be conducted by MP-470 staff of the Bureau of Reclamation's (Reclamation) Mid-Pacific Regional Office in Sacramento, California. The investigation is being performed at the request of Reclamation's Lahontan Basin Project Office in Carson City , Nevada through Reclamation's Mid-Pacific Hazardous Waste Coordinator (MP-405). MP-470 personnel involved include Chief of the Quality Assurance Branch (project head) and physical scientists specialized in field sampling and quality assurance/quality control (QA/QC). Analytical laboratory services are being provided by CH2MHILL's laboratory in Redding, California.

PROBLEM DEFINITION/BACKGROUND

This initial site assessment sampling plan focuses on the area defined as Indian Lakes (see figure 1) and will include soil and water sampling. The investigation is being conducted to determine 1) the extent of any mercury contamination at IL (IL is part of the Carson River Superfund site) 2) if a public health threat exists 3) whether there is any other trace metal

contaminants present at concentrations that would prevent the transfer of IL to the State of Nevada or the Bureau of Land Management. The assessment will determine the location and extent of contamination associated with lead, arsenic, mercury and other heavy metals possibly present in the surface soil (0-6") and of the surface water from the water bodies at IL.

As a result of elevated mercury levels in wildlife and sediment found in the Carson River watershed, IL has been included as part of the Carson River Mercury Super fund Site by the U.S. Environmental Protection Agency (EPA). EPA estimates that over 7000 tons of mercury was released into the Carson River watershed as part of the gold and silver mining operations. Mining in the Carson River drainage basin commenced in 1850 when placer gold deposits were discovered in the Comstock Lode near Virginia City, Nevada. Mercury introduced into the region in the late 1800's to process gold and silver ore from the Comstock Lode is thought to be the primary source of mercury contamination in the Carson River drainage basin. The Carson River drains 3,980 square miles in east-central California and west-central Nevada. The Carson River begins in the eastern Sierra Nevada Mountain range, south of Lake Tahoe and generally flows north eastward and eastward to the Carson Sink. The flow of the Carson River is interrupted west of Fallon, Nevada by Lahontan Reservoir, part of the Newland's Irrigation Project. Below Lahontan Dam, flow is routed through a complex network of ditches, drains, and canals. Irrigation flow eventually discharges to Carson Lake, Stillwater National Wildlife Management Area, or the Carson Sink.

The Indian Lakes area being investigated is part of the Stillwater National Wildlife Management Area and is owned by the U.S. Bureau of Reclamation. IL is located in west central Nevada, approximately 5 miles north of highway 50 and 4 miles east of the town of Fallon, Nevada. IL encompasses approximately 15,000 acres and numerous small lakes (Big Indian, Papoose, Likes, Upper, and Twin Lakes). The Carson River also bisects the northwest corner of the IL area. Water from the Carson River and drainage water from the Newlands Project provide most of the water supply for IL. IL is a multiuse area with hunting, camping, and picnicking being the most popular activities.

PROJECT/TASK OBJECTIVES AND DESCRIPTION

The objective of this investigation is to determine whether the soil and/or water in the IL area exceeds the EPA's hazardous waste level criterion for mercury, whether there is the possibility of mercury bioaccumulation to organisms, whether there is a health hazard to employees working at IL and to the public visiting IL and whether there are any other trace elements of concern in the IL area.

The field work is scheduled to commence on May 4, 1993 and be completed by May 18, 1993. Laboratory turnaround time is scheduled for 30 days from the receipt of the last sample to receipt of a full data package. Approved sample results will be available by June 9, 1993. Data evaluation and map generation is estimated to take another 14 days after sample results are received.

DATA QUALITY OBJECTIVES FOR MEASUREMENT

As the objective of this investigation involves health and safety concerns, data collection activities require a high degree of qualitative and quantitative accuracy. Samples will be taken in accordance with EPA approved sampling methods, and analyzed following EPA approved analytical methods by CH2M Hill Laboratory, located in Redding, California. Decisions and actions based on the data produced by this investigation must be made with a high degree of confidence in the quality and validity of the data. Therefore, the Quality Assurance Section of MP-705 will validate and assess all external quality assurance data and all internal laboratory quality control data before results are released.

DOCUMENTATION AND RECORDS

The final data report for the IL will include analytical results and a quality assurance summary review. Documentation backing this data will include results of instrument calibrations and laboratory QC checks such as duplicates, matrix spikes, and preparation blanks or method blanks. External QA sample results and summary review, as well as a field sampling narrative documenting any notable problems or occurrences during sample collection, will also be on file with Reclamation's Mid-Pacific Region Quality Assurance Branch.

SAMPLING PROCESS DESIGN

The soil sampling plan (including QA) will entail collecting a total of 32 samples. 22 soil samples will be collected at 0-6". 4 soil samples will be collected at 21-27" and the remaining samples will be part of the QA process. In addition, a total of 9 water samples (of which 3 are QA) will be collected.

The majority of the soil samples are being collected at the 0-6" depth because it is believed this depth presents the highest possible risk to human health from airborne exposure, dermal contact, and possible ingestion. This level will also probably contain the highest concentration of trace elements that could be bioaccumulated or taken up by plant roots. The 21-27" depth is being investigated to provide data on trace elements in the soil which may be accumulated by plant uptake in that rooting zone (the 21-27" zone was investigated because it is believed that zone represents the deepest most of the roots will be found). Water samples will be taken from the major water bodies in the IL area and will be analyzed for trace elements.

Composite soil samples (3 sites spaced linear 50 feet apart) will be taken using a Oakfield stainless steel soil push tube from 0-6". A stainless steel bucket hand auger will be used to collect the composite soil samples from 21-27". The push tube and/or auger will be cleaned and rinsed 3 times with deionized water between each new site. All sampling methods will be in accordance with EPA approved methods. The soil samples will be collected in 32 oz plastic wide mouth containers. Water samples will be collected into the appropriate container (glass for Hg and high density polyethylene for the

other metals). Each container will be labeled with a site specific identification number, date of collection, time of collection, analysis requested, and any preservation method. A certificate of analysis for container contamination will be filed at Reclamation's Mid-Pacific Regional Office (MP-470) located at 2800 Cottage Way, Sacramento, California. The sample containers will be placed in a cooler (that is cooled to 4 degrees C) with two chain of custody seals placed on the cooler to ensure sample security.

SAMPLE HANDLING AND CUSTODY REQUIREMENTS

A logbook will be used to record the following: conditions under which the samples are collected; person(s) collecting the samples; time and date of collection; sample identification number; and sample collection technique. Field sheets will be used to record the identification of the sample, any field measurements taken, collection date, and names of person(s) collecting the sample.

A chain of custody sheet will be used to record the sample identification, number of containers, analyses to be performed and dates and times documenting transfer of sample custody. The log book and the field sample sheets will be kept at Reclamation's MP-470 office located at 2800 Cottage Way, Sacramento, California. The chain of custody will accompany the samples from the site to the laboratory with a copy being filed in Sacramento.

ANALYTICAL METHODS REQUIREMENTS

CH2M Hill Laboratory will be required to adhere to EPA Method 7471 for digestion and analysis of total mercury in soils, and EPA Method 7470 for analysis of mercury in waters. Other metals in soils will be digested following EPA's Method 3050A and analyzed by ICP following the EPA Method 6010, with the exception of selenium which will be analyzed by graphite furnace, EPA Method 7740, for the lower detection limit.

QUALITY CONTROL REQUIREMENTS

As checks on precision, accuracy, and contamination, Reclamation's Mid-Pacific Region QA personnel will incorporate external quality assurance samples into the sample batches prior to submittal to the contract laboratory. These reference samples will include blank soils, certified soil reference materials, and field duplicates. These quality assurance samples will receive sample identification similar to all other samples in order to submit them to the laboratory as blind samples. The quality control criteria for these samples will be the same as that required for the laboratory quality control samples, following Reclamation Mid-Pacific Region's quality assurance guidelines as attached to the data results.

INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

Laboratory protocol for instrument maintenance procedures is specified in CH2M Hill's laboratory manual, on file with the Quality Assurance Branch. An on-site system audit was performed by Reclamation's MP-705 QA personnel in December 1991, and instrumentation was found to be up-to-date with well documented logbooks and service contracts with manufacturers in place.

INSTRUMENT CALIBRATION AND FREQUENCY

CH2M Hill Laboratory specifies instrument calibration procedures in the laboratory manual mentioned above.

DATA REVIEW, VALIDATION, AND VERIFICATION REQUIREMENTS

Sample results will be validated by QA personnel against Mid-Pacific Region's quality assurance acceptance criteria. Reanalyses will be requested as necessary where acceptance criteria is not met. Laboratory quality control results as well as external quality assurance sample results will be evaluated and qualified, and a narrative summary of the review and QA results will accompany the sample data report..

ASSESSMENT
of
INDIAN LAKES DATA

The primary objective of the Indian Lakes investigation was to determine whether the mercury level in the soil of this area exceed the Environmental Protection Agency's (EPA's) hazardous waste level criterion. A secondary objective was to assess whether mercury or any of the other 13 chemical constituents monitored pose a threat to either the environment in general or to public health in particular. Results from both of these objectives may also be used in the decision to transfer this land to the State of Nevada or the Bureau of Land Management.

In order to meet both objectives, 21 soil samples were collected at a depth of 0-6 inches and 4 soil samples were collected at 21-27 inches. The soil samples were analyzed for total concentrations of a suite of trace elements and heavy metals.

Assessing the soils in terms of the primary objective found them all to be well below EPA's hazardous waste criterion for total mercury in soil, 20 mg/kg wet weight. The three highest concentrations were 4.1, 2.9, and 0.81 mg/kg respectively. The soils were not measured for the soluable fraction of mercury or any other metals because of similarities between Indian Lakes and the Carson Lake Pasture area in which soils with higher total mercury levels were found to contain minute levels of soluable mercury. Since all soil samples were well below the action level for total mercury and other regulated

metals, the soils of the Indian Lakes area should not be classified as hazardous material.

The secondary objective can only be partially fulfilled without additional information. Because there are so many physical and chemical variables that can enhance or reduce the biological pathway and toxicity of chemicals present in the environment, one can only make gross assessments of potential environmental or public health impacts without designing specific studies to accurately measure them.

The first step was a general evaluation of the soil metal and trace element levels by comparing the total concentrations of the different elements in Indian Lakes soils to baseline levels in soils of the Western United States. The baseline levels were established by the U.S. Geological Survey and are described in a publication produced by Tidball and Ebens in 1976.

A comparison of the Indian Lakes soil results to baseline levels show aluminum, barium, beryllium, cadmium, chromium, copper, lead, lithium, nickel, selenium and zinc to be well within the normal range for western soils. However, the mean concentrations of arsenic, boron, and mercury are above the western background mean levels by 42%, 16%, and 1000%, respectively.

The second step in evaluating potential impacts to public health and biota was an assessment of surface water quality data compiled as a result of samples collected from five lakes within the Indian Lakes boundaries. Although the assessment was made somewhat difficult due to high salts in some of the waters interfering with the analytical method, the results did show that arsenic and mercury were at very high levels and selenium at a moderate level. These elements could present an aquatic life problem from chronic exposure and bioaccumulation. In addition, the high arsenic could pose a public health problem to those who utilize the area for recreation purposes from either ingestion of water, consumption of waterfowl, fish, or other aquatic organisms, or inhalation from airborne dusts. Arsenic has been catagorized as a carcinogen. Finally, boron was also measured at very high levels and may inhibit vegetative growth.

The three major routes of potential human exposure identified above can not be substantiated without additional research. A health risk assessment would require additional studies be performed to determine specific rates of exposure. The type of studies that could provide the data necessary to make a scientifically based human health risk assessment would include ambient and/or personal air monitoring, increased water quality sampling at lakes that see a lot of recreational use (body contact with the water), and monitoring the levels of toxics in the flesh and liver of organisms consumed by the public to determine dietary amounts.

Potential impact to biota, especially waterfowl, could be determined from studies that measure the diets of the organisms and birds that reside or seasonally utilize the Indian Lakes area. The environmental compartments that would have to be measured would include phytoplankton, zooplankton, invertebrates, fish, and various components of the native vegetation.

6/11/93

Indian Lakes Soil Samples
Collected May 4 & 5, 1993
Wet weight, mg/kg

Site	Element	Ag	Al	As	B	Ba	Be	Cd	Cr
IL-01		0.35	6040	3.7	16.2	53.3	0.34	<0.28	5.5
IL-02		<0.24	5080	1.8	14.8	34.3	0.26	<0.28	5.3

IL-04	<0.24	6870	5.0	41.8	44.8	0.33	<0.28	6.3
IL-05	0.24	7800	3.8	53.7	51.1	0.48	0.38	7.3
IL-06	0.30	3830	12.6	21.0	41.5	0.19	<0.28	3.5
IL-07	<0.24	3330	10.5	110	55.2	0.20	<0.28	3.4
IL-08	0.29	2800	9.4	11.4	37.0	0.20	<0.28	3.9
IL-09	<0.24	7120	12.4	15.0	65.1	0.36	<0.28	6.9
IL-11	0.51	23300	18.4	80.4	210	0.90	0.73	17.8
IL-12	0.29	4350	2.0	9.8	65.8	0.28	<0.28	5.3
IL-13	0.52	6980	16.4	11.3	73.6	0.38	<0.28	7.7
IL-14	<0.24	3300	11.6	8.6	56.0	0.27	<0.28	3.9
IL-15	<0.24	3170	6.6	8.2	37.6	0.20	<0.28	3.6
IL-16	0.34	12500	9.4	24.8	104	0.51	0.42	10.1
IL-17	0.32	5680	6.8	45.3	47.8	0.33	<0.28	4.6
IL-18	<0.24	4650	2.2	11.3	38.2	0.27	<0.28	5.2
IL-19	<0.24	2280	8.4	18.6	38.1	0.21	<0.28	2.5
IL-20	<0.24	2490	7.5	21.1	26.6	0.13	<0.28	2.9
IL-21	<0.24	4060	2.6	8.6	48.0	0.24	<0.28	4.6

Indian Lakes Soil Samples
Collected May 4 & 5, 1993
Wet weight, mg/kg

Site	Element	Cu	Hg	Li	Pb	Ni	Se	Zn
IL-01		8.8	0.36	8.8	<5.0	7.7	<0.12	24.6
IL-02		7.1	0.12	7.0	<5.0	4.5	<0.12	19.0
IL-04		12.7	0.10	17.5	7.0	6.6	<0.12	30.0
IL-05		11.2	0.45	13.6	6.4	6.0	<0.12	34.3
IL-06		8.6	2.9	6.4	7.8	4.6	<0.12	18.2
IL-07		6.2	0.24	7.5	<5.0	5.2	<0.12	16.7
IL-08		5.5	0.35	4.9	<5.0	6.7	<0.12	16.1
IL-09		11.4	0.20	10.5	<5.0	7.2	<0.12	29.5
IL-11		39.3	0.47	33.1	13.8	8.2	0.57	85.0
IL-12		6.7	<0.06	6.8	6.9	10.6	<0.12	19.4
IL-13		12.3	0.81	10.0	5.5	8.8	0.24	32.2
IL-14		8.5	0.68	6.0	6.6	6.3	0.23	20.0
IL-15		5.7	0.07	5.3	<5.0	5.4	<0.12	16.5
IL-16		20.3	0.44	19.6	11.2	11.9	0.18	48.3
IL-17		9.9	0.06	10.4	6.3	5.1	<0.12	24.2
IL-18		6.5	<0.06	6.1	<5.0	7.0	<0.12	20.9
IL-19		4.7	0.16	4.3	<5.0	4.6	<0.12	10.6
IL-20		3.9	0.08	4.3	6.0	3.8	<0.12	11.9
IL-21		7.1	<0.06	6.2	5.3	7.2	<0.12	19.7

6/11/93

Indian Lakes Soils
Quality Assurance Summary Review

Twenty-three soil samples were collected from the Indian Lakes area near Fallon, Nevada, on May 4th and 5th, 1993, and were submitted to CH2M Hill Laboratory in Redding, California for analysis by EPA digestion Method 3050. The samples submitted included the following external quality assurance (QA) check samples: one field duplicate, one collocated field sample, two reference soils, and an equipment rinseate blank. The laboratory reported analytical quality control (QC) data which is reviewed here as well.

The field duplicate relative percent differences (RPD's) were all within the Bureau of Reclamation (Reclamation) Mid-Pacific Region's acceptance criteria for soils. The RPD's between the regular sample at site IL-11 and the collocated sample, taken approximately fifty feet away to test the site variability, looked low with the exceptions of boron at 37% RPD, aluminum at 29% RPD, and silver at 28% RPD. All other metals were within 24% RPD or less between the two samples.

The reference soils had acceptable recoveries for all elements but aluminum and boron. Aluminum was barely acceptable in one reference sample (67% recovery), but had an unacceptable recovery (61%) in the other. Boron had high recoveries based on non-certified values in the references of 220% and 148%. However, boron was also present in the preparation blanks at levels of 2.2 and 2.9 mg/kg. When an average of 2.5 mg/kg boron is subtracted from the reference value results, the recoveries are 48% and 120% in the reference samples, indicating that a level of contamination between 1.2 and 2.9 mg/kg of boron may be present in the sample results. Boron results must be reviewed keeping in mind that an average level of possible contamination of 2.0 mg/kg is approximately 24% of the lowest boron sample result of 8.2 mg/kg, and 7% of the overall average boron value of 29.1 mg/kg.

The equipment rinseate blank showed low levels of a few metals such as aluminum and nickel, but these levels are insignificant when compared with the levels of the metals in the soil and would have no effect on the samples.

The laboratory QC results were acceptable with the exception of the boron levels mentioned in the preparation blanks, and a high arsenic spike recovery.

A post digestion arsenic spike was performed on the same sample with acceptable results, and as another arsenic spike as well as the reference sample recoveries were acceptable, arsenic results are judged to be valid.

The notable quality assurance results indicate that results of soil samples collected from the Indian Lakes area May 4th and 5th, 1993, are valid and useable data with possible low level (2 mg/kg) boron contamination, and slight low bias of aluminum results.

8/12/93

Indian Lakes Soil Samples
Collected May 18, 1993
Wet weight, mg/kg
"A" Denotes sample taken 0-6" below surface
"B" Denotes sample taken 21-27 " below surface

Site Element	Ag	Al	As	B	Ba	Be	Cd	Cr
IL-03A	<0.40	7940	12.9	34.0	105	0.32	0.31	6.2
IL-03B	<0.40	17500	5.8	38.5	182	0.48	0.67	9.8
IL-05B	<0.40	5790	4.1	14.6	71.7	0.25	0.22	5.6
IL-10A	<0.40	7690	9.4	11.9	121	0.34	0.26	7.3
IL-10B	<0.40	5250	4.1	7.7	56.5	0.25	0.29	5.0
IL-18B	<0.40	4010	7.6	18.9	61.3	0.29	<0.20	4.4

Indian Lakes Water Samples
Collected May 18, 1993
ug/l

Site	Element	Ag	Al	As	B	Ba	Be	Cd	Cr
IL-08		<2.0	2450	292	7320	195	<1.0	<1.0	<3.0
IL-09		<2.0	11600	248	3250	212	1.4	<1.0	7.5
IL-14		<2.0	140	35.7	439	49.8	<1.0	<1.0	<3.0
IL-19		<2.0	5290	537	24700	341	<1.0	<1.0	4.3
IL-20		<2.0	282	692	26400	112	<1.0	<1.0	<3.0

8/12/93

Indian Lakes Soil Samples
Collected May 18, 1993
Wet weight, mg/kg
"A" Denotes sample taken 0-6" below surface
"B" Denotes sample taken 21-27 " below surface

Site	Element	Cu	Hg	Li	Pb	Ni	Se	Zn
IL-03A		19.4	4.1	18.9	5.7	7.8	0.25	38.5
IL-03B		20.3	0.06	58.6	9.0	11.9	<0.12	54.9
IL-05B		10.0	0.08	12.6	<5.0	5.8	<0.12	30.0
IL-10A		14.6	0.60	14.3	6.7	6.7	<0.12	39.7

IL-10B	12.5	0.43	7.4	<5.0	3.6	<0.12	22.7
IL-18B	9.7	<0.06	7.0	<5.0	7.2	0.51	23.0

Indian Lakes Water Samples
Collected May 18, 1993
ug/l

Site	Element	Cu	Hg	Li	Pb	Ni	Se	Zn
IL-08		5.3	1.0	199	<25.0	<10.0	14.6	13.1
IL-09		18.8	1.4	134	<25.0	<10.0	<0.60	43.9
IL-14		3.1	0.28	40.0	<25.0	<10.0	<0.60	<4.0
IL-19		16.8	0.56	447	<25.0	15.2	<60.0	29.2
IL-20		<3.0	0.34	251	<25.0	12.4	<60.0	<4.0

8/11/93

Indian Lakes Water and Soils
Quality Assurance Summary Review

On May 18, 1993, an additional eight water samples and nine soil samples were collected from the Indian Lakes area near Fallon, Nevada, and were submitted to CH2M Hill Laboratory in Redding, California, for analysis. The soil samples were digested following EPA Method 3050, and included a field duplicate and two reference soils. A rinseate blank from the soil sampling

equipment was submitted with the water samples, as well as a duplicate and spiked duplicate water samples. The laboratory analyzed and reported the sample results with a Level 2 QC packet of laboratory QC results, which were reviewed and found to be acceptable.

Soils

The external quality assurance samples submitted with the soil samples showed mostly acceptable results. The rinseate blank from sampling equipment showed insignificant levels of a few metals and was below detection for all others. The Relative Percent Differences (RPD's) between regular and duplicate results were all within acceptance limits, and recoveries of the reference materials were acceptable with the exception of one slightly low aluminum recovery (64%) and one high mercury recovery (150%). Upon reanalysis, aluminum showed a recovery of 99%, but mercury dropped to only 135% recovery. Therefore data must be reviewed keeping in mind that a possible low bias exists for aluminum results while a high bias may exist in mercury results.

Waters

The results of external quality assurance samples submitted with the water samples indicated a few problems. The duplicate RPD's were unacceptable for aluminum, chromium, and zinc results. The spike recoveries were unacceptably low for five metals and high for arsenic. Reanalyses were requested and results indicated that sample matrix may have caused variability and interference. The RPD's improved for aluminum from 86% to 27%, for chromium from >1xDL to 34%, and for zinc from 61% to 30%. While these results are better, the RPD's still do not meet acceptance criteria, and may indicate that matrix effects are influencing precision.

The spike recoveries upon reanalysis improved for arsenic, cadmium, chromium, copper, selenium, and silver. However, criteria was still not met for selenium (61% and 71% recovery) and silver (<47% and 167% recovery). Given the variability of results (changes were both positive and negative in concentration) for the regular, duplicate, and spiked samples, reanalysis of other samples in the batch was determined to be unnecessary. The results reported for the regular sample were either the original or reanalysis result based upon evaluation of that parameter in the regular, duplicate and spiked samples and their reanalyses as well. The original results for all other water samples are reported with the following qualifications.

Silver may have a low bias, with recoveries possibly as low as 50%. Selenium, chromium, and copper may have a low bias of close to 70% recovery. Arsenic may be biased as high as 140% recovery. Aluminum demonstrated both a possible low bias and a wide variability upon reanalysis. Zinc and chromium also demonstrated variability with zinc results of 23.5 ug/l initially and 59.0 ug/l in the reanalysis of the duplicate sample, and chromium resulting in <3.0 ug/l initially and 9.7 ug/l upon reanalysis of the duplicate. Yet the regular sample showed changes of only 43.9 ug/l to 43.7 ug/l for zinc, and 7.5 ug/l to 6.9 ug/l for chromium.

Qualifications in summary

The notable quality assurance results for samples collected from the Indian Lakes area near Fallon, Nevada on May 18, 1993, indicate that results for soils may have a low bias for aluminum and a high bias for mercury. Results for waters demonstrated a wide variability for aluminum, zinc, and chromium, and possible low bias of recoveries for silver, copper, chromium, selenium and aluminum. Arsenic may be demonstrating a high bias in water samples.

Bureau of Reclamation, Mid-Pacific Region

Acceptance Criteria for Inorganics in Soils

Duplicates:	For values > 5X Detection Limit, Relative Percent Difference (RPD) ≤ 35%
	For values ≤ 5X Detection Limit, difference must be within ± 2X detection limit
Spikes:	Recovery should be 65% - 135%
	Limit does not apply when sample value exceeds spike concentration by 5X or more
Reference soils:	Recovery should be 65% - 135% for values ≥ 20X Detection Limit for soils digested by similar method to that used to obtain certified values
	For values < 20X Detection Limit, recovery should be ± 4X Detection Limit from the certified value
Blanks:	Blank concentrations should be less than 10% of lowest sample concentration

Acceptance Criteria for Inorganics in Water

Duplicates:	For values ≥ 20X Detection Limit, RPD ≤ 20%
	For values < 20X Detection Limit, difference must be within ± 1X Detection Limit

Spikes: Recovery should be 80% - 120%

Limit does not apply when sample value exceeds spike concentration by 5X or more

Reference materials: Recovery should be 80% - 120% of the certified value for values $\geq$ 20X Detection Limit

For values < 20X Detection Limit, recovery should be $\pm$ 4X Detection Limit from the certified value

Blanks: Blank concentrations should be less than 10% of lowest sample concentration